

## **Long term impact of mental calculation sessions on primary PGCE students**

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In the summer of 2008, I worked with a small group of primary PGCE students and discovered that a brief taught session on mental calculation strategies had a significant impact on their final teaching placement (Davis 2009). In order to evaluate whether there was any longer term impact, I have revisited some of those students who are now approaching the end of their second year of teaching. These initial findings of this ongoing research show that all of these teachers have taught a significant amount of mental calculation methods, and all have a strong belief in the importance of discussion of children's strategies.

**Keywords: mental calculation; primary; impact**

One of my strongest memories from being a child in primary school is that of completing a mental mathematics test every Friday afternoon, in preparation for the 11+ examination (selection for the local grammar school) during the final year. We were taught no strategies, other than learning multiplication tables by rote. Questions were fired at us and we had to calculate the answers 'in our heads' as the Dutch call this type of calculation (Thompson 1999). For me, this merely meant picturing the formal written calculation and carrying out the formal method, working as quickly as possible, jotting down first the unit part of the answer, then the tens etc. It was not until many years later, as I trained to teach, that I realised that there was more to 'mental calculations' than this. The fact that I could choose from a range of strategies and use my knowledge of the number system to calculate much more efficiently was astonishing. Shortly after this, mental calculation became an important feature of the English primary mathematics curriculum when the National Numeracy Strategy was introduced (DfEE 1999) and strategies were expected to be explicitly taught and regularly rehearsed and discussed. The recent 'Williams Review' (DCSF 2008) has called for a refocusing on oral and mental maths in order to particularly benefit under-attaining groups of children.

There is, however, some contention about whether or not mental strategies should be taught. Threlfall (2002), for example, believes that the full range of strategies are too numerous to teach, and that a solid understanding of the number system is needed so that when faced with a particular calculation a child can select from their own knowledge of the numbers involved rather than select from a range of particular strategies. Thompson's definition of mental strategies, though, includes knowledge of the number system as part of this development, so mental calculations can involve using known facts, particular strategies and knowledge of the number system (1999, 2000). On a personal level I know that I have been far more efficient and accurate at mental calculations since being introduced to some strategies, but I have to acknowledge the implications of Murphy (2004) and Torbeyns et al's (2009) studies which found that learning these strategies does not necessarily mean that children will use them.

## **Background**

Two years ago I conducted a study of five Initial Teacher Education (ITE) students (Davis 2009) to identify what mental calculation strategies they possessed, how confident they were to teach mental strategies to children and whether my teaching of a range of strategies could increase their confidence of teaching this topic. Huntley (2005) and Goulding et al (2002) suggest that there is a direct link between a student's own subject knowledge and their confidence in teaching the topic. The results of my study showed that whilst these students knew only a limited range of strategies before my intervention, they became much more confident afterwards and for two of them there was a clear impact on their teaching during the following few weeks of Teaching Experience in school. However, Haggarty et al., (2009) provide evidence to suggest that once students qualify to teach, the practice they observe in school often overrides their learning during the university part of teacher training, and they can lose their enthusiasm for their own learning during their NQT year, tending to just focus on behaviour management rather than subject knowledge.

In this study I return to three of these ex-students (Donna, Ellie and Belinda) to investigate whether there has been any longer term impact on their teaching and confidence, or whether, as has been suggested, the influences from their first school overrode any benefit. Using a combination of questionnaires, semi-structured interviews and evidence from their planning I gained information to inform case studies.

### **Overview of each teacher**

#### ***Donna***

Donna worked in a Year 1 class for her first year of teaching and is just completing a year of part time teaching in the same school, covering Reception (F2), Year 1 and Year 2. She has continued to teach a number of skills to support mental calculation, namely:

- Taught and practised doubles and halves regularly
- Taught lots of counting on strategies
- Fast recall of number facts
- Mental calculation strategies have been practised in PE lessons
- More able Year 1s have been encouraged to consider which strategy is the most appropriate for a given calculation

Donna believed that much of this was as a direct result of my intervention. She recalls clearly the usefulness of discussing her own strategies with the rest of the students and has ensured that children, particularly the more able, have been given the opportunity to discuss their own methods. She encourages children to decide which is the more efficient method and which is the one they feel most comfortable with. Whilst she believes she may have taught this way anyway, as a result of my intervention she is more overt than she might otherwise have been.

#### ***Ellie***

Ellie spent her first year of teaching as a regular supply teacher in one school, teaching across the whole primary range and also taking Year 6 'booster classes' for children who might fall just short of the expected level for their end of Key Stage 2

tests. Her second year of teaching has been with a Year 5/6 class. Like Donna, she has developed skills to support mental calculation, particularly:

- Taught and practised doubles and halves regularly
- Division by 4, related to percentages
- Discussion of strategies

Similarly Ellie recalls the range of different methods used by the small group of five students two years ago and says that this has had a long term impact on her teaching.

### ***Belinda***

Although Belinda trained on our age 5 – 11 course she has taught full time in the year below this age group, in a reception (F2) class, since she qualified. Even with these very young children Belinda has been teaching and practising the following skills:

- Doubles
- Mental addition
- Putting largest number in your head
- Sequences
- Choice of own resources.
- Discussion of strategies

### **Initial Findings**

Despite this study including just a small sample of teachers, there appears to be strong evidence to suggest that there has been a longer term impact of my initial intervention on each of them. Donna believed that her focus on the discussion of strategies was as a direct result of my sessions:

Sue: Do you think there has been any impact of those two sessions you attended with me?

Donna: Definitely, definitely ..... probably even more so this year because I've been working more with year 2....trying to get the children to explain to me the different strategies and then explain why they would choose a particular one and why it was better, and picking out the features. It really stuck with me that when we were talking, how useful that was, so I've done that quite a lot with the children in the class. Definitely.'

Sue: And was that something you might have picked up anyway on your TE placement?

Donna: I might have done but I think that really rammed it home, that.., how important it was for the children to find out for themselves which ones work for them and which ones are....are more efficient than, than others, erm and that unless you get them to think about what they're doing and why they're doing it they might not, you know, I think I was just more overt with it than maybe I would have been anyway.'

Interestingly, all of these teachers encouraged discussion of strategies, and all believed that some of the children they taught were able to select an appropriate strategy from the range they had been taught. For Belinda and Donna, working with younger children, this selection was encouraged more for their higher achieving children, although the actual discussion of strategies took place with all children.

A key strategy which was taught by all three teachers was that of doubling numbers, whether with four year old or eleven year old children. From the interviews it was clear that they had all realised during the intervention sessions that a

knowledge of doubles could be used in a variety of ways to support mental calculation, and for this reason they had chosen to include this strategy at the appropriate level for their particular children. Indeed, all three mentioned this strategy within the first two minutes of their interview. As Ellie put it:

Ellie:.....near doubles, doubling of numbers..OOH..year 5 and 6 I've done lots of trying to explain about dividing by...finding quarters and dividing by 4s because they can't always see that actually, if you halve and halve again you can really find, they're ever so simple aren't they? If you are doing percentages and you are trying to find things...

Sue: So it's back to those doubles and halves that we'd...

Ellie: Doubles and halves, I tell you, doubles and halves I bang on about that (laughs)

Sue: (laughs) But even with year 6s

Ellie: Yes, even with year 6s, yes because they can't always see that and very quickly, how do you find 25% of that....well I don't know....it's a quarter so half and half ... and then they can do it.

Memorising doubles and rehearsing using these was also a frequent focus of the mental/oral part of maths lessons in Belinda's reception class, but it was difficult for her to quantify how much of this related to my intervention and how much she would have taught as part of the school's planning anyway.

As could probably be expected from their very different experiences during their first two years of teaching, these students had identified different areas that they had made most improvement on. As suggested by Haggarty et al., (2009), two of the students rated behaviour management as a main focus for improvement, whereas the third student, Belinda, rated this last after general teaching skills, subject knowledge and classroom management. Quite surprisingly, though, according to the questionnaires completed at the beginning of the study only one of the three teachers studied (Donna) felt 'very confident' at teaching mental calculation strategies, despite the range of strategies that they were each able to discuss during their interviews. As I continue to analyse my data I will be considering reasons for this apparent lack of confidence.

#### Conclusion

Larose et al. (2009) stress the importance of the NQT year as a time when beginning teachers put into practice the theory learned at university. From this initial analysis of my findings it would appear that the most significant aspect of teaching mental calculation which these three teachers carried forward was the discussion of strategies used by the children. As Ellie pointed out, 'I very often get them to, to explain to me what they've done, because I'm amazed at how many different ways children can do it.'

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